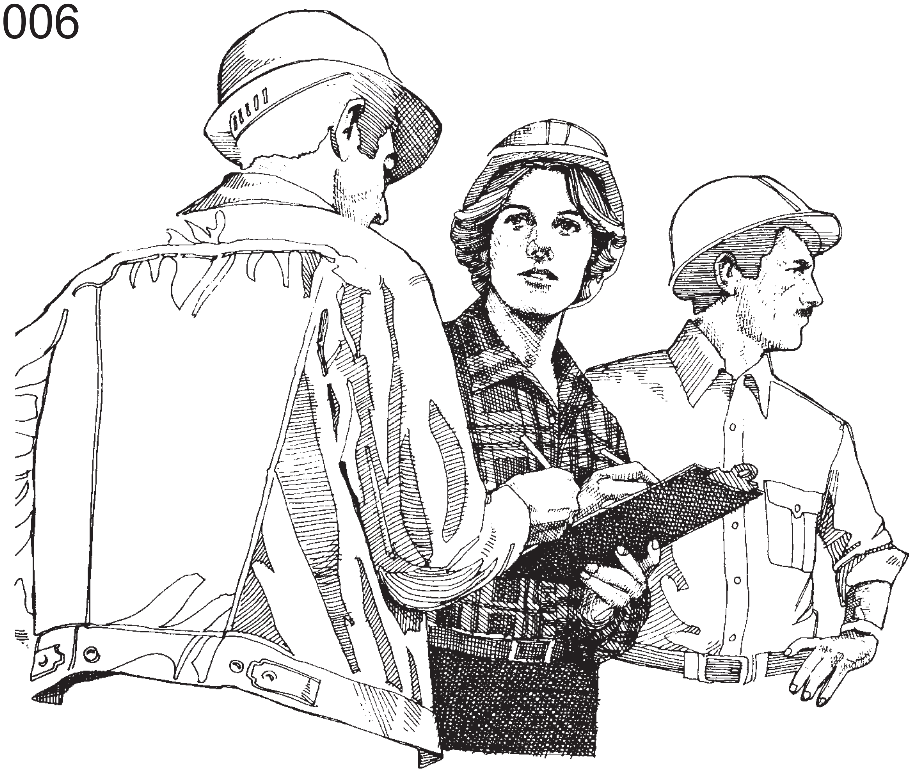
Hot Mix Asphalt Placement Inspection

Construction Inspector's Training Manual

January 2006



Washington State
Department of Transportation

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Environmental and Engineering Programs
Construction Office

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Introduction

Part 1 Introduction

Objectives

This course will enable you to:

- Understanding HMA specifications and the rationale behind them
- Identify current industry standards
- Perform your assigned inspection duties

Importance of Inspection

The technology of asphalt materials and mixes is continuously changing. Many excellent handbooks can be obtained through agency and industry publications to assist paving inspectors achieve a complete understanding of the current paving practices.

This course is designed to familiarize the inspector assigned to the paving inspection, their duties for the placement of the Hot Mix Asphalt (HMA).

Agency personnel should exercise tact and good judgment in securing maximum cooperation on the part of the Contractor.

An onsite review of the roadway conditions can reveal areas of repair and drainage issues, which may not be addressed in the plans prior to paving operations. Bring these concerns to the attention of the Project Engineer and Materials Engineer as soon as they are discovered.

After the inspector has had the time to review the plans and specifications, he will have more confidence and abilities to solve potential construction related problems.

Approved traffic control plans must be strictly adhered to. When conditions exist that are not addressed in the contract plans, immediately notify your Project Engineer.

The Construction Manual under section 5-4.1 gives general instruction for the inspector assigned to a paving project.

Definitions

ACP

Asphalt Concrete Pavement same as Hot Mix Asphalt (HMA)

ATB

Asphalt Treated Base (considered a base not ACP)

BST

Bituminous Surface Treatment, commonly called “chip seal”

CSTC

Crushed Surfacing Top Course

CSBC

Crushed Surfacing Base Course

Asphalt Tack Coat

A light application of asphalt emulsion applied to an existing Asphalt or Portland Cement concrete surface. It is used to ensure a bond between the existing surface and the new pavement.

Bleeding or Flushing

The migration of asphalt binder to the surface of an asphalt pavement.

Ruts

Channelized depressions caused by the displacement of the aggregate structure, due to wheel loading.

Raveling

The loss of aggregate particles from the surface or edges of a pavement due to insufficient of binder.

SAMI

A stress absorbing membrane interface used between an existing roadway surface and a new layer of asphalt concrete to prevent existing cracks from reflecting through to the new surface.

Shoving

A form of plastic movement resulting in “humping” of the pavement.

SMA

Stone Matrix Asphalt, which is a Gap-graded hot mix asphalt

Safety

The subject of safety should be a major concern to everyone involved with the paving project. Agency personnel should take the lead in maintaining a high level of awareness for situations that may cause injuries or accidents.

Many WAC's, RCW's and department policies have been enacted to ensure accident prevention. Manuals like the MUTCD have guidelines that we follow to protect us in our work zones.

The Department of Labor and Industries along with other outside agencies enforce the compliance of safety and health regulations on our jobsites.

There are three areas of immediate concern:

1. Hearing loss
2. Injury/death caused by moving vehicles on construction sites
3. Traffic control setups

We need to work together with the contractor to provide the safest possible working environment.

Guiding the traveling public through the project with the least amount of confusion or disruption will greatly enhance safety. The inspector should drive through the work area to monitor the traffic flow and validate that the approved traffic control plans are adequate for the conditions.

Construction safety zones are listed in the Special Provisions. These items are set up for accident prevention and must be enforced by the inspector. Contractor's nonessential vehicles and employees private vehicles shall not be permitted within the safety zone unless protected as described in the contract. Agency personnel should also park in areas as not to create a hazardous condition.

Agency personnel are being held to a higher standard and accountability for their driving habits. Always be aware that your actions are being scrutinized by the customers, which fund our projects.

Part 2

Asphalt Pavements

Pavement Types

The process of construction, type of binder and aggregate gradations categorize the type pavements.

There are several types of pavements, which are used on the Washington State highway system. The most common is a dense graded Hot Mix Asphalt (HMA).

Basic Properties

Durability vs. Stability

Durability is a measure of service life in relation to deterioration of the asphalt concrete pavement due to weather conditions. Asphalt cement is a durable binder that holds the aggregate particles together. Asphalt cement also gives flexibility to the pavement that the aggregates themselves cannot provide.

Stability is resistance to displacement of the asphalt concrete pavement caused by traffic loading. Displacement causes rutting. Crushed particles add to the stability of a mix due to the friction between the angular faces.

The stability value of each mix is highest at low asphalt content, in contrast to the durability value, which is greatest at a higher asphalt content.

Insufficient asphalt binder cannot "glue" the aggregate particles together, and excessive asphalt binder exceeds the available space in the aggregate skeleton, which pushes the particles apart.

During the mix design process a compromise between these two values are met to determine the optimum asphalt content.

Pavement Failures

Pavements deteriorate over time due to various environmental factors, which include weather and traffic loading.

Contract specifications are in place to minimize failures due to the use of substandard materials and improper construction practices. The street inspector assigned to the paving project can assure that the maximum pavement life will be met by adherence to these specifications.

Part 3

Inspection

Pre-pave Meeting

A meeting with the paving contractor and appropriate sub-contractors is an important part of the paving process. A complete checklist for conducting this meeting may be found in the Construction Manual under section 5-4.1.

Inspector Tools

10 foot Straightedge

Locate bumps and depressions in pavement surface

Thermometers

Hand Held Noncontact Infrared - find Cyclic Density Differencials
Probe Thermometer - determine internal temperatures of the mat

String-line

Check crown in screed on the paver
Locate high and low areas for Preleveling of existing surface

Slopeboard or Smartlevel

Verify the transverse slope of the roadway

Depth Gauge

Check mat thickness before and after rolling

Vibratory Tachometer

Monitor vibrations per minute on vibratory roller

Report Forms

Inspectors Daily Report
Asphalt Concrete Test Section Report
Asphalt Concrete Pavement Compaction Report
Item Quantity Tickets (IQT's)

Miscellaneous Equipment

Measuring tape
Rag tape
Paint

Project Staking

Centerline Stationing

Offsetting of the existing centerline striping before paving can aid in reestablishing pavement markings.

Super Elevations

If the contractor will be using electronic slope control on the paver to put in super elevations the roadway cross slopes and transitions must be staked with the percent of slope.

Utility Locations

Reference points (RPs) for manhole covers, water valves, monuments, and other objects that are within the paving section must be placed. It is suggested that a minimum of two reference points be set for each item that is to be relocated after paving. Marking with GPS is beginning to be a common practice.

New Construction

Prior to paving over newly constructed surfacing, the Street Inspector should make time to check out the grade. Cross slope and profile between reference hubs can be checked with a string line or swede to assure HMA quantities will be met. This is especially important if the surfacing material has been completed a number of days prior to paving. If the surfacing material has dried and there are loose larger aggregates on the surface commonly referred as pop corning, it is suggested that the grade be watered and rolled to lock the larger aggregate in place.

Pavement Repair

Pavement repair is an integral part of maintaining the structural integrity of the roadway. The contract plans will specify the type and amount of repair to be used, but in some cases additional work may be required to achieve adequate service level and service life.

If the deterioration of the pavement has accelerated in which there are deficient areas not addressed, contact the Project Engineer and Regional Materials Engineer for clarification.

In this section, we will discuss the most commonly used construction practices of repairing asphalt concrete pavement due to the type of pavement failure encountered.

Digouts

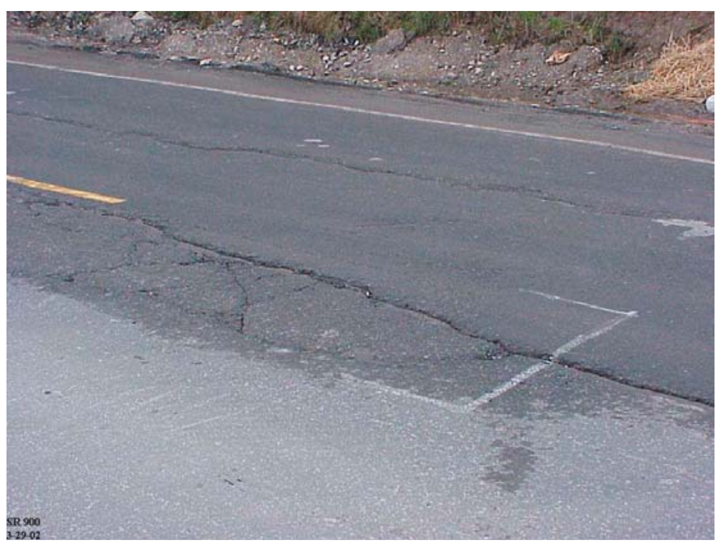
Block cracking also known as "alligator cracking" is a common pavement surface condition, which indicates a dig out will be necessary. This will require removal of the pavement, surfacing and possibly unsuitable subgrade material. The depth of the digout varies with the pavement structure and extent of moisture susceptibility to the subgrade material.

The pavement surface of a digout area shall be either milled or perimeter saw cut to achieve a vertical edge. Wheel cutting or jack hammering will not be acceptable.

All areas of distressed pavement need to be removed to ensure a firm stable base.

Digouts of considerable length in the same lane of travel, with short sections of undistressed pavement between them, need to be continued as one digout.

The efficiency of the repair process should be considered. Small patchwork areas, which are harder to construct and achieve adequate compaction, should be avoided.



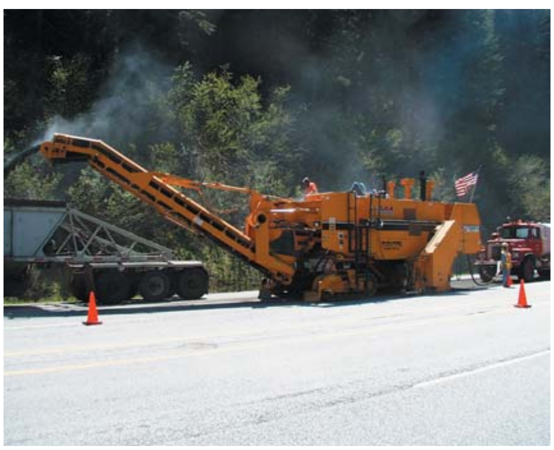
Planing

It is a common practice to rehabilitate wearing surfaces using the perpetual pavement design concept. Planing also referred to as “milling” or “grinding” is done to remove the top of existing distressed asphalt pavement surface. This is performed to achieve the lowest life cycle cost for that segment of roadway.

Some pavement surface conditions that would benefit from this type of repair are top down longitudal cracks that stop at the preceding pavement layer, rutting in the wheel paths, and “humping” at intersections.

In some cases, milling can uncover situations that may have led to the pavement failure. Some failures are due to poor construction practices on the previous paving contract. If you encounter underlying roadway deficiencies during the planing operations, contact your Project Engineer and Regional Materials Engineer for direction on how to repair the area.

Along with examining the surface after milling, the inspector should also be checking the depth of the pavement removal and cross slope. If too much existing asphalt is removed or if the profiler is not cutting to the proper slope, the replacement tonnage of hot mix asphalt (HMA) will increase the cost significantly.



Crack Sealing

Examine the surface to determine the types, sizes, and number of cracks to be sealed. Excessive cracking should be discussed with the Project Engineer. Crack sealing is usually paid by force account, so maintaining an accurate record of the equipment, materials, workforce, and hours worked is essential.

Cracking sealing procedures will be detailed in the Special Provisions or Section 5-04.3(5)C of the *Standard Specifications*.

Close inspection of this item is needed to assure proper practices are adhered to.

Pre-Leveling

Pre-leveling of the roadway is done to:

- Fill wheel ruts within travel way.
- Fill in dips and depressions.
- Bring super-elevations to proper slope.

In most cases, due to the thin paving lifts a small stone HMA is used.

When filling in large dips, the contractor should place the mix in horizontal thin layers that overlay each proceeding lift. This is to prevent the possibility of adding bumps to the roadway surface and to achieve a better compacted mix.

Paving Equipment

The Construction Manual Section 5-4.2B states, *"It is the duty of the Street Inspector to inspect the Contractor's paving equipment to verify the equipment meets the contract specifications."* It also lists inspection requirements for each type of paving equipment.

In 5-04.3 of the Standard Specifications, various equipment needs are addressed. Review the contract special provisions, which may require a specific type of equipment to be used on your contract.

It is most important that on completion of the equipment check, note any deficiencies and bring them to the attention of the Contractor. Record corrective actions of the Contractor for the listed deficiencies in your Inspector's Daily Report.

Tack Coat

The importance of bonding the new pavement structure with the old pavement surface cannot be over emphasized. To assure the integrity of the pavement structure, each layer needs to be bonded together as in a "glue lam" beam. If the pavement layers are left to work independently, the structure will fail prematurely.

Standard Specifications require the use of an asphalt emulsion for tack coats. The asphalt emulsion most commonly used is CSS-1, which possess a positive charge and low viscosity that gives it superior penetration properties.

The emulsion consists of asphalt, water and an emulsifying agent. When sprayed on the roadway surface, the water evaporates and the tack is said to have "broke".

Preparation

Prior to the emulsion (tack) being applied, the existing roadway surface needs to be cleaned. Sweeping, vacuuming, flushing or combination of each can accomplish this.

A thin layer of dust on the roadway surface can cause the tack not to adhere to the roadway and will be picked up by the contractor's equipment.

Application

Although there is no pay item for tack coat, it is a major concern that the contractor follows the specifications addressing this issue. Premature pavements failures have been directly associated with improper tack applications.

The Street Inspector should keep "Shot Notes" to verify correct tack applications are being applied.

Application rates are calculated by gallons per square yard of retained asphalt after the water has evaporated.

Industry standards found in the Asphalt Institute handbook MS No. 22 gives guidelines for appropriate application rates at 0.05 to 0.15 gal/sy.

The required application rate is the amount of emulsion needed to be placed onto the roadway surface to achieve the required asphalt residue.

This is done by taking into account the type of emulsion, temperature of emulsion, the percent of water added, and size of area to be covered.

Tack Coat Application — Practical Exercise

Tacking a 14 foot wide section of road from Sta. 50+25 to Sta. 71+45, you and the Contractor have agreed to a residual application rate of 0.05 gallons per square yard. Temperature of the CSS-1 is 100°F. The Contractor added 1000 gallons of water to 1000 gallons of emulsion in the field.

What are the required gallons of diluted emulsion to achieve a residual application rate of 0.05 gals./sq. yd. for this section of roadway?

The first step in the calculation is to find the percentage of residual in the CSS-1 from Section 9-02.1(6) of the *Standard Specifications*, percentage of residual is 57%. Calculate the required rate;

Divide the residual rate by the percentage of residual:

________ ÷ _________ = _________ desired application rate gal/sy

The water added must be calculated into the rate:

Desired rate ÷ % of water added = required application rate gal/sy

_________ ÷ ________ = _________ required application rate gal/sy

Calculating the required gallons:

Beginning station	50+25
Ending station	71+45

Length of tack shot = ______________ lineal feet

Length covered x width covered = square feet covered

________ x ________ = ____________ square feet

Square feet covered ÷ 9 = square yards covered

____________ ÷________ = ____________ square yards

Square yards x application rate = Gallons of (cold) emulsion required

____________ x ________ = ________ (Cold) gallons required

From the Temperature-Volume correction table in Appendix A, correct the number of hot gallons required for the true application:

Cold gallons ÷ correction factor = Gallons of (hot) emulsion required

____________ ÷ ____________= ____________ (Hot) gallons

Delivery of Mix

Scale checks

All materials paid based on weight are subject to the requirements listed in the Standard Specifications and the Construction Manual.

Agency personnel will periodically observe the weighing operations and scale checks performed by the contractor at a commercial scale operations. These checks are to be unscheduled and not less than twice a week.

Note these visits and what you observed in the Scaleman's Daily Report.

Delivery Ticket

Construction Manual guidelines in chapter 10-2.1C mandates that every ton of HMA incorporated into the project are to be accounted for.

To accomplish this, a person at the jobsite is assigned the task of receiving each load ticket. This ticket becomes a source document to pay for the material. It is the responsibility of the receiver to check that all information on the ticket is correct and initial that they have done so.

Computing Yields

The Regional Materials Engineer has prepared the resurfacing report that provides minimum depths at which the pavement structure is designed. For this reason achieving the plan paving depth is our greatest concern.

Total quantities of HMA to be place are found in the contract plans. In addition, the Roadway Sections depict the design depth of asphalt to be placed.

To assure that these quantities are met and excessive over runs do not occur, a running average for depth and quantities should be calculated.

It is the Street Inspector's responsibility to meet but not exceed these quantities.

Calculating the yields is generally delegated to the person receiving the load tickets.

Computing Yields

Checking Yield — Practical Exercise

A total of 19.56 tons of HMA is placed in 160 feet at a paving width of 12 feet.

First, calculate the compaction density that should correlate at 4% air voids. The volumetric property Gmm is 2.542 and Gmb was measured at 2.440.

Gmm x 62.24 = Rice Density

____________ x ____________ = *____________lbs/cf

(** Rice Density x 96%) x 27 = (Compaction density) lbs/cy

**____________ x ____________ = ____________lbs/cy

Lbs/cy ÷ 2000 lbs/ton = tons/cy

____________ ÷ ____________ = ____________tons/cy

Tons placed ÷ tons/cy = Cubic yards
____________ ÷ ____________ = ____________ Cubic yards

Convert cubic yards to cubic feet

Cubic yards x 27 = Cubic feet
____________ x _____________ = ____________ Cubic feet

Calculate compacted depth

Cubic feet ÷ square feet (L x W) = Compacted depth
____________ ÷ ____________ =____________ Compacted depth

If plan depth is 0.15' is a correction to the paving depth required?____________

* Note: This is the value used by the Density Operator

** Note: This value should correspond closely to the Nuclear Gauge reading

Temperature Checks

None of the various factors affects the final pavement structure more than temperature. It plays an integral part, from the mixing process to the time traffic is permitted on the new pavement.

The Street Inspector should pay close attention to the temperature through out the delivery and lay down process.

Viscosity Curves from the supplier should be requested from the Contractor. Valuable information can be obtained on performance of the asphalt binder at specific temperatures. Extreme temperatures can damage the binder during the mixing process, so it is essential that the delivery temperature be monitored.

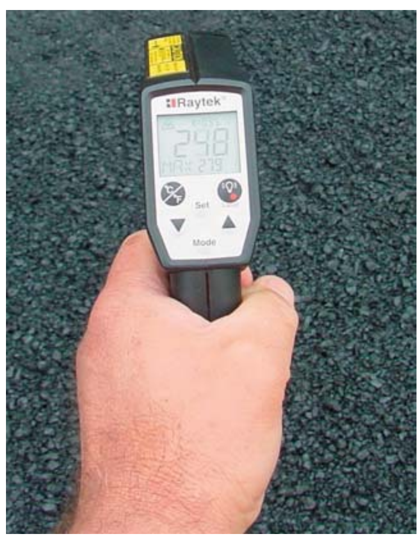
Viscosity Curves are unique to each grade of binder and asphalt supplier.

Temperature differentials behind the paver can indicate a permeable area where water intrusions can occur. These areas may be observed in cyclic patterns that are associated with the end of each delivery. Others appear as longitudal streaks that are related to the paver operation.

Use of the Infrared Thermal Camera or Non-contact Infrared Thermometer can be invaluable in detecting these deficiencies.

Standard Specifications reference internal temperatures, which cannot be measured by the infrared technology we have. A verified probe thermometer must be used. Care should be taken when recording these readings due to the thinness of the paving depths.

If you locate areas of concern, immediately notify the Contractor and mark them for additional density testing.



Appearance of Asphalt Mix

There are visual cues that may indicate a change in the HMA being delivered to the project. If you witness any of these indicators notify the Contractor and plant inspector immediately.

Uncoated aggregates are referred to as “Grey Backs” and indicate that the mixing process is not correct.

A dry appearance generally means there is a low binder content and is sometimes associated with a fine mix.

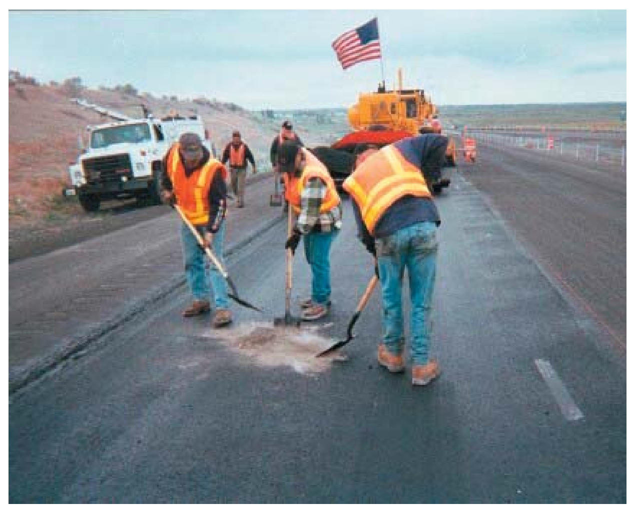
If a coarse pocket behind the paver is observed, check for thermal segregation with the thermal camera or infrared thermometer.

Large stones or oversized material in the mix is generally attributed to improper loader operation, picking up material from the stockpile floor.

A sign that the mixture has been stored to long will be chucks of cold consolidated HMA in the mat behind the paver. The time between production and laydown should be evaluated.

Slick spots on the mat may appear as isolated or cyclic. Check the trucks, rollers and paver for hydraulic or fuel leaks.

Hydraulic rams are likely to leak



Spill cleanup is essential

Joint Construction

Transverse Joint

It is required that a paper joint be used at the end of the work shift when the transverse joint will be open to traffic. For safety concerns the temporary wedge will be constructed at a taper of 50H:1V or flatter.

Longitudinal Joint

Longitudal joints pose a major safety issue when left open to traffic, especially to motorcyclists. They are also one of the primary construction related pavement failures, due to the low density achieved during compaction.

Studies have shown a dramatic improvement in safety and a reduction in longitudinal joint failures with the use of the notched wedge joint.

Standard Specifications require a “heavy” tack coat on all longitudal joints, this will assure that the joint can resist water intrusion.

Transverse paper joint

Notched Wedge
Longitudal Joint Construction

Surface Smoothness

The International Ride Index (IRI) measures pavement smoothness. Some regions are incorporating a specification utilizing the IRI for evaluation of the Contractor's performance in the paving process and to assure a quality ride.

Bridge seats and takeoff joints are gererally associated with rough areas in the pavement. It is the Street Inspector's duty to enforce the specifications concerning transverse joints and have the Contractor make corrections at the time of placement.

A smooth wearing surface begins in the subsurface layers.

If a smoothness specification is employed, the Contractor will need at least two attempts to correct the deficiencies. This can be accomplished with a pre-leveling course or planing of the subsequent layer.

There are many manuals outlining industry standards on correct paving practices for attaining a smooth pavement. Following these standards will give our customers the economic benefits they desire.

Compaction

Proper compaction techniques comes with a scientific approach, which includes knowledge of all materials involved and a complete understanding of the equipment to be used.

Existing Base

Compactive effort needed to achieve desired results relies on the type and condition of base to be paved. Soft or distressed areas will absorb the dynamic energy generated by the compaction equipment, leading to premature failure of the new pavement.

If the contract has no pavement repair item to correct these deficiencies, contact your Project Engineer and Regional Materials Engineer for guidance.

HMA Components

Hot Mix Asphalt mixture is comprised of air, asphalt binder and aggregates.

Mix design criteria targets optimum air voids of 4%. Standard Specifications allows the Contractor a maximum of 9% in-place air voids.

Asphalt binder is a complex elasto-plastic material that changes properties and characteristics at certain temperatures. Anticipating those changes will give the Contractor a significant advantage in meeting the requirements.

Aggregates make up approximately 90% of the HMA mixture. Shape, texture and gradation form the internal friction and create the resistance to deformation.

Compaction Equipment

Rollers

Rollers are classified into 3 groups: Vibratory, Static and Pneumatic

Dependant on the existing base and HMA being placed, determines the type of roller to be used. Each type of roller employs complex and unique forces. Matching the forces to the existing conditions is an art, which can only be perfected through experience.

Proper operation of the rollers is most effected by the viscosity of the asphalt binder and internal friction of the aggregate structure. Binder viscosity changes with temperature. A high temperature "thins" the binder, which lubricates and lets the aggregate particles orientate, where as a low temperature "glues" the particles in place.

Rolling is accomplished in three stages dictated by the mix temperature.

Stages of rolling

Vibratory rollers are used in the breakdown and intermediate stages. These rollers can also operate in the Static mode for certain circumstances.

Pneumatic rollers sometimes referred to as "rubber tired rollers", are generally used during the intermediate stage, but can be effective as a breakdown roller for some HMA mixes.

Breakdown should be accomplished immediately after lay down, when the mix temperature is highest. This assures that the aggregate particles have optimum opportunity to re-orient their positions for maximum consolidation. This occurs at the lowest viscosity of the asphalt binder.

The intermediate stage begins when the asphalt binder characteristics change from a lubricate to a cement. Monitoring of the pavement temperature to achieve desired compaction levels is very critical for this stage.

Finish rolling is completed after the new pavement has cooled sufficiently, so that the aggregate particles are locked in place and the marks from the proceeding rollers can be removed. Finish rollers are exclusively static rollers, which may have vibratory capabilities. Street Inspectors should be vigilant that the finish roller is operated in the static mode.

Test Section

Paving depth, air and base temperatures are some of the factors resulting in the rate at which the HMA mixture cools down. A compaction test section can help isolate these unknowns and establish the best combination of roller type and compactive effort needed to achieve the desired levels. This will dictate the maximum rate of the production, haul and laydown processes.

Striping

Temporary

Temporary striping is required if the roadway will be opened to traffic prior to the permanent striping. It is extremely important that the correct color be applied in the proper location and spacing.

Painted temporary markings shall be top-dressed with glass beads for retro reflectivity.

Removal of temporary tape shall be accomplished with minimal blemish to the pavement surface.

Temporary markings can be paved over with the wearing course of HMA.

Permanent

Necessary control points need to be established and referenced prior to the paving operations.

The color of the material used for spotting shall match the color of the permanent marking.

Two applications of paint will be required to complete all paint markings with a minimum drying time of 4 hours between applications.

The Street Inspector shall verify the paint thickness of each application for adherence to the specifications.

Fine Grading

After paving is complete, the vertical edge on the shoulder needs to be "dressed" with crushed surfacing.

This dressing serves to armor the pavement edge and reduce damage, due to shoulder rounding. It also provides a safety feature to motorists that may drive off the pavement edge.

Common construction practice for this operation is to place the crushed material on the paved shoulder, then blade, broom, flush and compact the material.

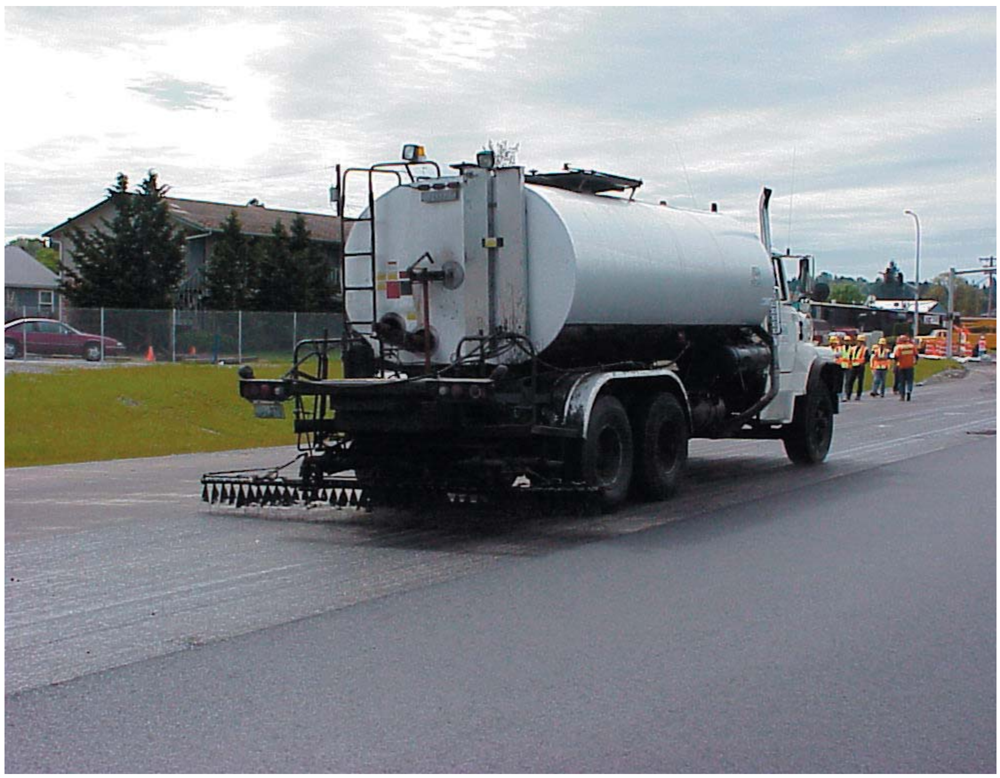
An important inspection duty is to assure the Contractor properly compact the material so that no loose material will enter on to the roadway and become a hazard to the traveling public.

Fog Seal

The purpose of a fog seal is to compensate for a coarse mix with thin film coatings, thermal segregations that occur in transport or laydown and inadequate consolidation of the mix during compaction.

A fog seal cannot remedy these deficiencies, but may prolong the deterioration process of oxidization.

To properly apply the fog seal an emulsified asphalt product of low viscosity is needed, most commonly used is CSS-1 that is diluted 50/50 with water. Since we are using a very fluid material, the application equipment needs to be monitored or excessive material will be applied.



Part 4

Documentation

Pay Notes

In the administration of a contract, measurements of contract quantities and records of such quantities have to be detailed enough to sustain an audit.

Records of all activities pertaining to the contract should contain sufficient details to be read and understood by anyone unfamiliar with the project.

Chapter 10 of the *Construction Manual* sets up the requirements and guidelines for the necessary documentation.

All inspectors should review this chapter in detail and have a complete understanding of the documentation process.

Source Documents

A source document is information conveyed to the office from the field personnel. It verifies the field measurements in relation to the proposed contract totals for that item of work.

This information can be displayed in various ways and is used to pay the contractor for work performed.

Over runs should be validated by sketches or drawings to depict changes and recalculated for corrections to the plan quantities.

Items such as CSTC, HMA and Asphalt for Fog Seal measured by the ton, can be documented with ***Weigh Tickets*** or ***Item Quantity Tickets***.

Planing, pavement repair excavation, shoulder finishing and asphalt concrete approach which are measured with square yards, square feet, lineal feet or each should be sketched out and listed by station limits on a ***Field Note Record***.

Other items like anti-stripping additive only require the ***Bill of Lading*** from the supplier to verify type and quantity used.

A ***Compaction Test Report*** is filled out by the Density Operator to record the In-place densities for statistical acceptance and final compacted pavement depth.

Inspector's Daily Report

DOT form 422-004 EF is a two-part document that the Street Inspector fills out in a complete and concise manner. Part 1 is a structured form, prompting the inspector to address questions pertaining to work activity, equipment in use and workforce. Part 2 form 422-004B should be used for paving operations. It has many prompts specifically associated with paving activities. Pictures should supplement the IDR to substantiate all Contractor activities.

Appendix A

Temperature-Volume Correction Table for Emulsified Asphalts

Temperature-Volume Correction Table for Emulsified Asphalts

°C^t	°F	M*	°C^t	°F	M*	°C^t	°F	M*
10.0	50	1.00250	35.0	95	0.99125	60.0	140	0.98000
10.6	51	1.00225	35.6	96	0.99100	60.6	141	0.97975
11.1	52	1.00200	36.1	97	0.99075	61.1	142	0.97950
11.7	53	1.00175	36.7	98	0.99050	61.7	143	0.97925
12.2	54	1.00150	37.2	99	0.99025	62.2	144	0.97900
12.8	55	1.00125	37.8	100	0.99000	62.8	145	0.97875
13.3	56	1.00100	38.3	101	0.98975	63.3	146	0.97850
13.9	57	1.00075	38.9	102	0.98950	63.9	147	0.97825
14.4	58	1.00050	39.4	103	0.98925	64.4	148	0.97800
15.0	59	1.00025	40.0	104	0.98900	65.0	149	0.97775
15.6	60	1.00000	40.6	105	0.98875	65.6	150	0.97750
16.1	61	0.99975	41.1	106	0.98850	66.1	151	0.97725
16.7	62	0.99950	41.7	107	0.98825	66.7	152	0.97700
17.2	63	0.99925	42.2	108	0.98800	67.2	153	0.97675
17.8	64	0.99900	42.8	109	0.98775	67.8	154	0.97650
18.3	65	0.99875	43.3	110	0.98750	68.3	155	0.97625
18.9	66	0.99850	43.9	111	0.98725	68.9	156	0.97600
19.4	67	0.99825	44.4	112	0.98700	69.4	157	0.97575
20.0	68	0.99800	45.0	113	0.98675	70.0	158	0.97550
20.6	69	0.99775	45.6	114	0.98650	70.6	159	0.97525
21.1	70	0.99750	46.1	115	0.98625	71.1	160	0.97500
21.7	71	0.99725	46.7	116	0.98600	71.7	161	0.97475
22.2	72	0.99700	47.2	117	0.98575	72.2	162	0.97450
22.8	73	0.99675	47.8	118	0.98550	72.8	163	0.97425
23.3	74	0.99650	48.3	119	0.98525	73.3	164	0.97400
23.9	75	0.99625	48.9	120	0.98500	73.9	165	0.97375
24.4	76	0.99600	49.4	121	0.98475	74.4	166	0.97350
25.0	77	0.99575	50.0	122	0.98450	75.0	167	0.97325
25.6	78	0.99550	50.6	123	0.98425	75.6	168	0.97300
26.1	79	0.99525	51.1	124	0.98400	76.1	169	0.97275
26.7	80	0.99500	51.7	125	0.98375	76.7	170	0.97250
27.2	81	0.99475	52.2	126	0.98350	77.2	171	0.97225
27.8	82	0.99450	52.8	127	0.98325	77.8	172	0.97200
28.3	83	0.99425	53.3	128	0.98300	78.3	173	0.97175
28.9	84	0.99400	53.9	129	0.98275	78.9	174	0.97150
29.4	85	0.99375	54.4	130	0.98250	79.4	175	0.97125
30.0	86	0.99350	55.0	131	0.98225	80.0	176	0.97100
30.6	87	0.99325	55.6	132	0.98200	80.6	177	0.97075
31.1	88	0.99300	56.1	133	0.98175	81.1	178	0.97050
31.7	89	0.99275	56.7	134	0.98150	81.7	179	0.97025
32.2	90	0.99250	57.2	135	0.98125	82.2	180	0.97000
32.8	91	0.99225	57.8	136	0.98100	82.8	181	0.96975
33.3	92	0.99200	58.3	137	0.98075	83.3	182	0.96950
33.9	93	0.99175	58.9	138	0.98050	83.9	186	0.96925
34.4	94	0.99150	59.4	139	0.98025	84.4	184	0.96900
						85.0	185	0.96875

Legend: t = observed temperature in degrees Celsius (Fahrenheit)
M = multiplier for correcting volumes to the basis of 15.6°C (60°F)

* Multiplier (M) for °C is a close approximation

Appendix B

Reference Documents

1. WSDOT *Standard Specifications for Road, Bridge, and Municipal Construction*, M 41-10
2. Amendments to WSDOT *Standard Specifications for Road, Bridge, and Municipal Construction*
3. WSDOT *Construction Manual*
4. The Asphalt Institute, *Principles of Construction of Hot-Mix Asphalt Pavements*, Manual Series No. 22
5. The Asphalt Institute, *A Basic Asphalt Emulsion Manual,* Manual Series No. 19
6. *The Asphalt Handbook*, Asphalt Institute, Manual Series No. 4 (MS-4), 1989 Edition
7. *Hot Mix Asphalt Paving Handbook 2000*, U.S. Army Corps of Engineers, AC 150/5370-14A Appendix 1